CPSC 314, Written Homework 3

Out: Thu Jun 2
~~Due: Wed Jun 8, 4pm.~~ CHANGE: Fri Jun 10, 4pm
Value: 5% of final grade
Total Points: 90

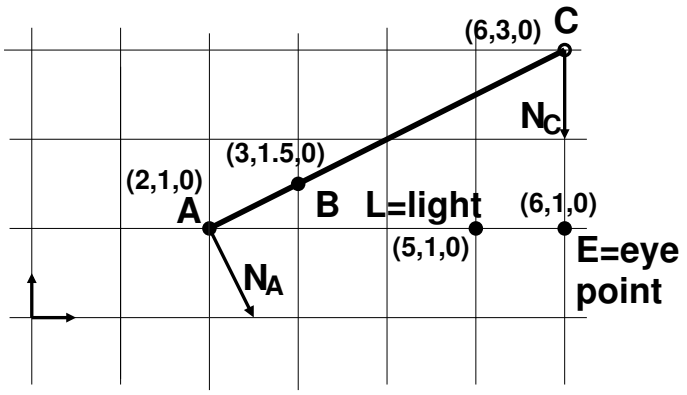
Rasterization (15 pts)

1. (15 pts) Give an algorithm for scan-converting a line with the Bresenham approach that works in the sixth octant (lines with slope between **positive** 1 and infinity), rather than the first octant as described in class (lines with slope between 0 and 1).

Lighting (30 pts)

For the following questions, give the ambient, diffuse, specular, and combined total illumination at each of points A, B, and C. **Treat the line segment AC as the 1D version of a polygon, where only the vertices A and C have normals defined. Note that the picture has changed from the previous version.** In cases that require computing only at a single vertex, use point C. Show your work. In all cases use the Blinn-Phong illumination model with the halfway vector, using parameters

$$I_a = (.2, .5, .2), I_L = (1.0, 1.0, 1.0), k_a = (.1, .1, .1), k_d = (.3, .8, .7), k_s = (.8, .8, .8), n = 20.$$



2. (10 pts) Do your computations in the flat shading model.
3. (10 pts) Do your computations using the Phong shading model.
4. (10 pts) Do your computations using the Gouraud shading model.

Clipping (17 pts)

5. (10 pts) Clip the line segment with endpoints (-1,-2), (2,2) to the box (-1,-1), (1,-1), (1,1), (-1,1). Use the Cohen-Sutherland algorithm and show intermediate work at each step, including outcodes. Use the following clipping order: bottom, top, left, right. You **do** need to compute the exact intersection points.
6. (7 pts) Clip the polygon with points P1 = (2, 2), P2 = (2, -2), P3 = (0, -1.5), P4 = (1.5, 0), P5 = (-1.5,-1.5) against the box (-1,-1), (1,-1), (1,1), (-1,1). Use the Sutherland-Hodgeman algorithm: give the vertex list after clipping against each viewport edge. Use the following clipping order: bottom, top, left, right. You do **not** need to compute the intersection points. If you have to insert a new point between vertices A and B, call it A_B.

Texture and Interpolation (30 pts)

7. (10 pts) Given the triangle T = (P1,P2,P3) with P1 = (-2,-1,0,1), P2 = (2,1,-1,1), and P3 = (3,0,-4,1) and with texture (s, t) coordinates at the vertices defined as (.25,.1), (.8,.8), and (.6,1) respectively, compute s for P **with x and y coordinates** = (.5, .5). Use the standard barycentric coordinate formula. **You are given only the x and y coordinates for P, as would occur during scan conversion where z values inside the polygon are interpolated given the z values at vertices.**

8. (DELETED, DO NOT ANSWER) Find the s texture coordinate at triangle midpoint P as above, but this time using perspective-correct barycentric interpolation.

9. (10 pts) Given the triangle above, find s using the plane equation.

Color (8 pts)

10. (2 pts) If a light with RGB color triplet (1,.5,0) shines on a surface with diffuse color (.2,.5,1), what is the resulting color triplet?

11. (6 pts) Convert the RGB triplet (.6,.3,.4) to YIQ.